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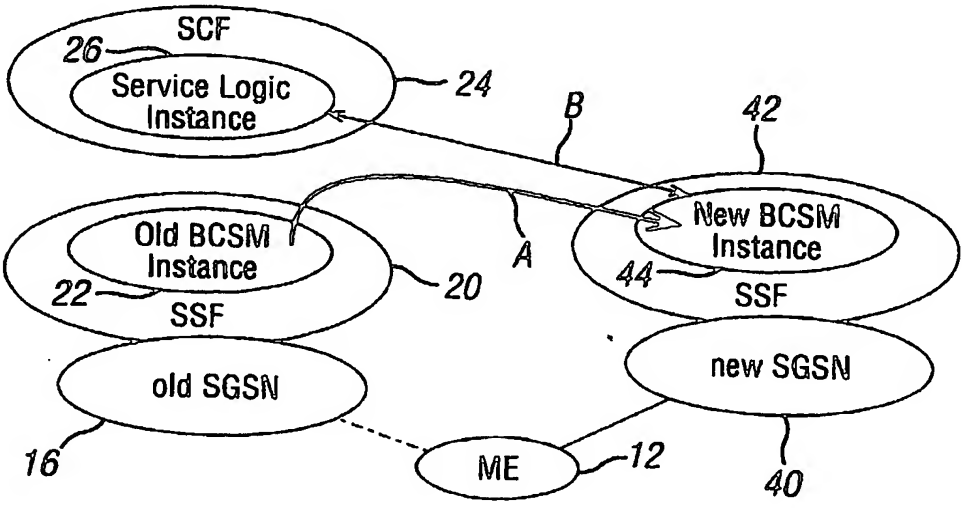
(54) Abstract Title
Providing Intelligent Network services while roaming in a packet switched mobile telecommunications network

(57) In a General Packet Radio Service (GPRS), when a mobile user roams from one Serving GSM Support Node (SGSN) to another while using an Intelligent Network (IN) service, a state model of the call is transferred from a Switching State Function (SSF) in the former node to one in the new node so that dialogue with the Service Control Function (SCF) can continue. The model is the Intelligent Network Basic Call State Model (BCSM) plus Points In Call (PIC) and Detection Points. The invention allows real time applications such as video to be fully supported when a user roams from one support node to another.

FIG. 4



GB 2 364 858 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1

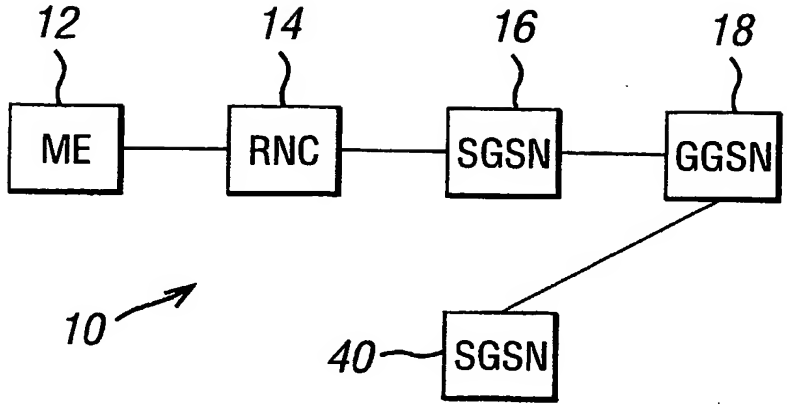

12
14
16
18
ME
RNC
SGSN
GGSN
10
40
SGSN

FIG. 2

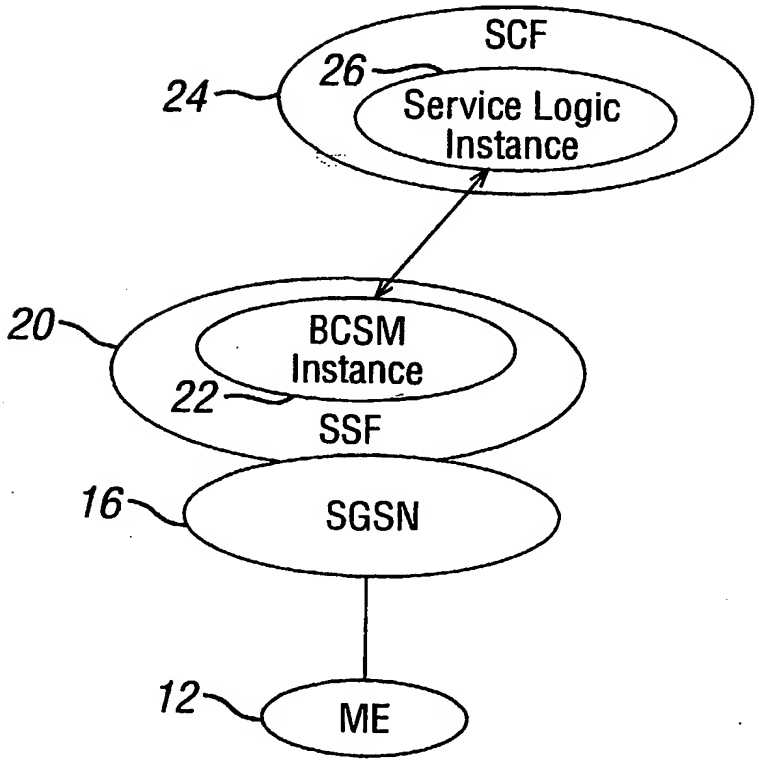

SCF
24
26
Service Logic Instance
20
BCSM Instance
22
SSF
16
SGSN
12
ME

FIG. 3

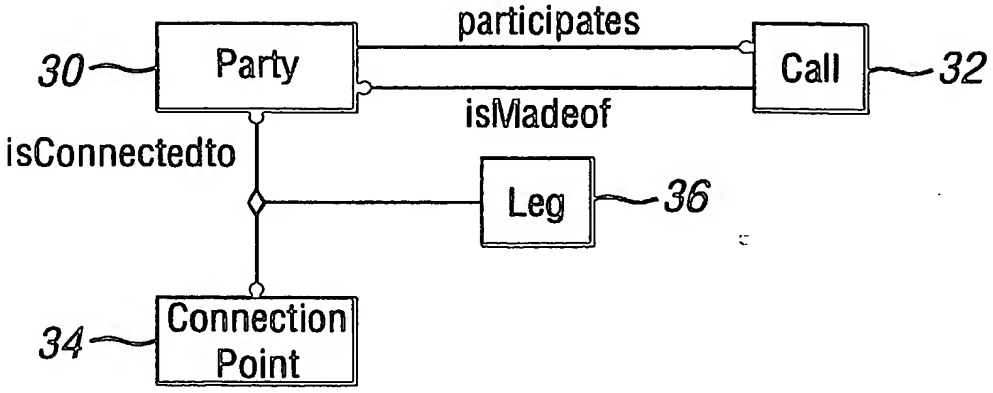

participates
30
Party
Call
32
isMadeof
isConnectedto
Leg
36
34
Connection Point

FIG. 4

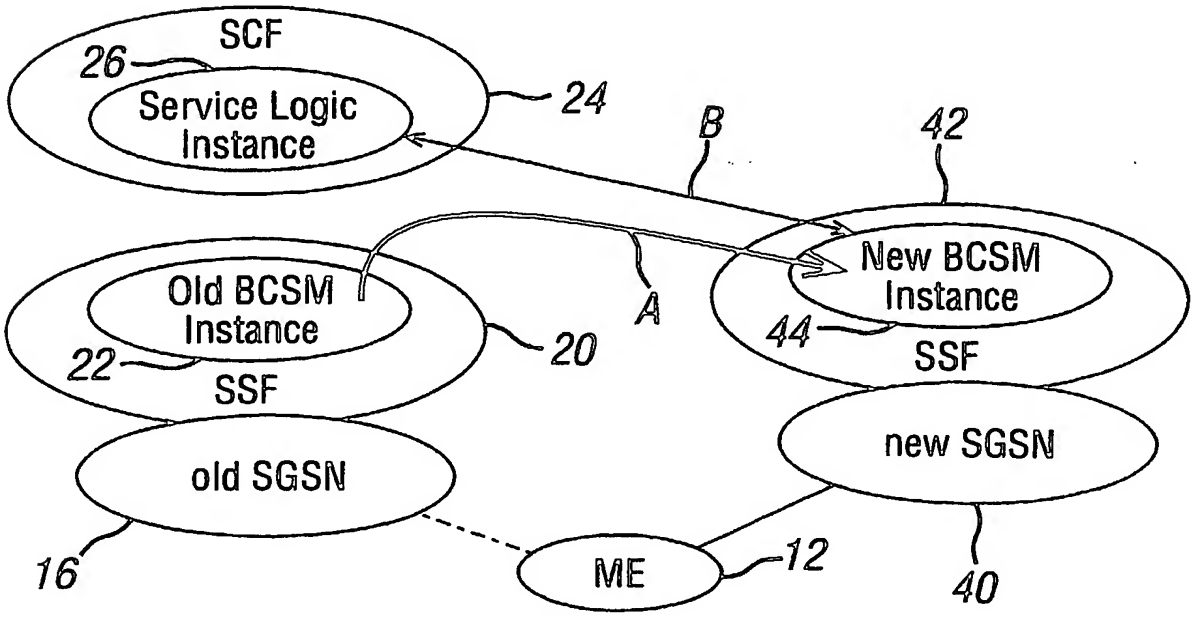
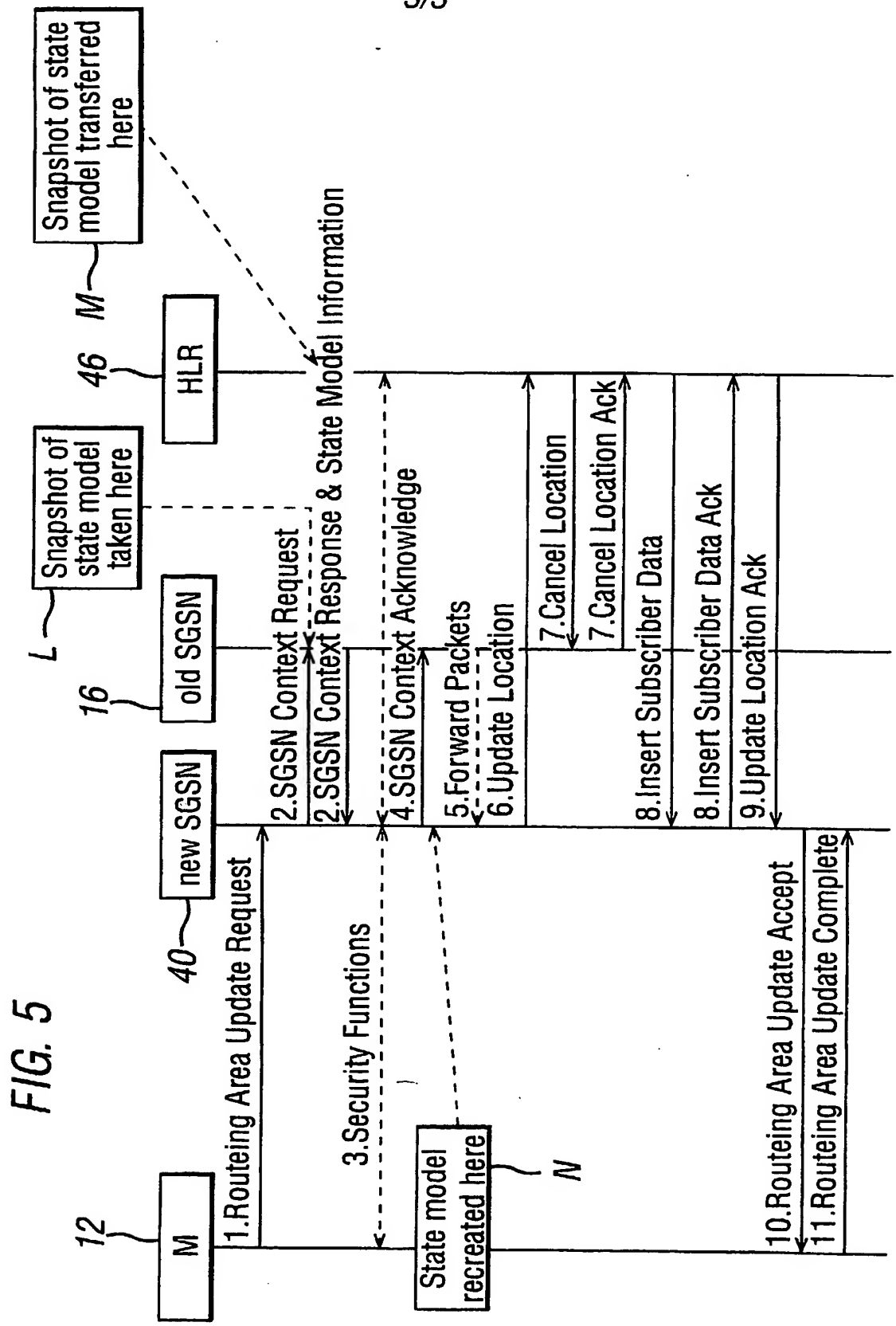

SCF
26
Service Logic Instance
24
B
42
New BCSM Instance
A
Old BCSM Instance
20
22
SSF
44
SSF
new SGSN
old SGSN
16
ME
12
40

FIG. 5


12
M
40
new SGSN
16
old SGSN
L
Snapshot of state model taken here
46
HLR
M
Snapshot of state model transferred here
1.Routeing Area Update Request
2.SGSN Context Request
2.SGSN Context Response & State Model Information
3.Security Functions
4.SGSN Context Acknowledge
5.Forward Packets
6.Update Location
7.Cancel Location
7.Cancel Location Ack
8.Insert Subscriber Data
8.Insert Subscriber Data Ack
9.Update Location Ack
State model recreated here
N
10.Routeing Area Update Accept
11.Routeing Area Update Complete

2364858

PACKET SWITCHED MOBILE TELECOMMUNICATIONS NETWORK SUPPORTING REAL TIME APPLICATIONS FOR MOBILE USERS

This invention relates to a packet switched network, for example the General Packet Radio Service (GPRS), and allows support of real time applications, such as video, when a mobile user roams from one support node to another support node.

In a conventional, circuit switched network such as GSM (Global System for Mobile communications), there is an anchor switch for each mobile user, usually in the Mobile Switching Centre (MSC), so that even when a mobile roams and becomes associated with another MSC, the call is routed back to the original, or anchor, MSC.

In GPRS there is no facility for providing an anchor switch. If a mobile moves from one Serving GSM Support Node (SGSN) to another, the new SGSN takes over the call connection entirely. The state models in the former SGSN are deleted, and new state models are created in the new SGSN, so that real time applications such as video cannot be fully supported.

Currently there is activity to provide integration between GPRS and Customised Application Mobile Enhanced Logic (CAMEL), but the developments are mainly to provide flexible charging for use of GPRS. A relationship has been created between the gsmSCF (GSM Service Control Function) and the SGSN based on subscription data. A new network entity has been introduced, the gprsSSF (GPRS Service Switching Function). Two state models can be created, one for modeling attach/detach procedures and the other for modeling individual packet data protocol contexts.

It is an object of the invention to utilise this new network entity to provide enhanced service for mobile users.

According to the invention, in a packet switched radio telecommunications network, a method of providing improved service when a mobile user roams from association with one support node to another support node comprising the steps of:-

recording a state model of the call;

transferring the recorded state model from a former support node to a new support node; and

recreating the state model in the new support node.

In the drawings, Figure 1 illustrates schematically a GPRS network and Figure 2 illustrates a mobile user served by a support node.

The invention will be described by way of example only with reference to Figures 3 to 5 in which :-

Figure 3 illustrates a model of a call;

Figure 4 illustrates transfer of the mobile user to a new support node; and

Figure 5 illustrates the exchange of messages.

In Figure 1 a GPRS network 10 comprises a multiplicity of Mobile Equipments (MEs) of which one only is shown at reference 12; a Radio Network Controller (RNC) 14, a SGSN 16 and a Gateway GPRS Serving Node (GGSN) 18 are shown. The GGSN 18 also serves other SGSNs such as 40.

The ME 12 and SGSN 16 are also illustrated in Figure 2. As referred to above, the specification in GSM 22.078 for release 99 has created the network entity gprsSSF, reference 20 in the SGSN 16; the SSF can create state models. Within the SSF 20 is a Basic Call State Model (BCSM) 22, defined in the context of a call control protocol in use, such as H.323 or Session Integration Protocol (SIP). The BCSM can provide a model of a call to the intelligent layer of the network, when the call control signaling is not transparent but is recognised by the SGSN. The BCSM allows a Service Logic Instance 26 residing in a Service Control Function (SCF) 24 to be aware of the call states of the underlying call processing; the SCF is not directly aware of this call signaling but, via the state model, can know the states of the call processing.

In Figure 2, suppose that an Intelligent Network service is influencing the call; an instance of the service logic program is executing the IN service. Figure 3 is a model of a call, illustrating several objects, each object having one or more attributes. Thus the Party 30 participates in many (indicated by the shaded circle) Call Session 32; a Call Sessions 32 is made of many parties such as Party 30. One Party 30 can be connected to one or many Connection Points 34, and a connection is formed of Legs 36. The objects in the model are therefore legs, parties, connection points and call sessions. There may for example be five parties and four legs making up one call session.

The call attributes include, for example, what the called number is, and whether it is a speech call or a video call.

Such a representation using object oriented techniques provides a model which

can, at any point in time, be used to capture a snapshot of the call.

Object oriented techniques are used in the ITU (International Telecommunications Union) specification Q.122x and the ETSI (European Telecommunications Standards Institute) specification EN301 141-1 covering the Intelligent Network Switching State Model (IN-SSM). The IN-SSM uses object orientated techniques to describe the state of the call and the related connections maintained by the SSF and CCF (Call Control Function); in the prior art, the modeling is used for the IN manipulation of multiple parties, i.e. Call Party Handling. Such modeling allows an abstract view of a two party or multi party call segment in terms of abstract objects, and these objects can be manipulated by the SCF.

Every IN based service consists of a BSCM at the SSF (see Figure 2), which is an abstract representation of the underlying call processing; this model identifies points in call processing where interaction between the network signaling and an intelligent layer of the network is allowed. Association with these points (Points In Call, PIC), are Detection Points (DPs) which provide the notification to the intelligent layer that a particular PIC has been reached. If the DP is armed, i.e., if the SSF has chosen to be informed about this point or event being reached, then the intelligent layer is informed; if the DP is not armed, the call processing continues without interruption.

In the inventive technique, the IN-SSM objects are combined with the PICs and DPs in the BCSM; a model of a call is created and is maintained in the SSF.

The merits of such a model are that it can be regarded as providing, at any time, a "snapshot" of the status of the call control that is presented to the SCF. The snapshot includes a representation of the objects (Figure 3) and their attributes; further, the snapshot can be transported over standardised network-network protocols to another SSF.

Figure 4 illustrates a mobile 12 roaming from a former SGSN 16 to a new SGSN 40, with its associated SSF 42 and BCSM 44.

In the prior art, a mobility management message "Routing Area Update Request" message results in the deletion of the state models in SGSN 16 and the creation of new models in the new SGSN 40. In the context of using GPRS/CAMEL interaction to address charging issues, this is acceptable. However, for real time

applications such as voice and video, call transfer problems arise. Intelligent Network-based services cannot work correctly.

In the inventive arrangement of Figure 4, when the ME 12 transfers from the former SGSN 16 to the new SGSN 40, the snapshot or BSCM Instance 22 is transported from the old SSF 20 to the new SSF 42 (arrow A). This transport of the BSCM instance allows the same service logic instance 26 to establish a two-way relationship with the new SSF 42 (arrow B) while retaining the same state information held in the old SSF 20; as stated above transferred information includes the armed events so that dialogue between the SSF and the SCF 24 can continue.

The information can be transported over a standardised network-network protocol.

Figure 5 illustrates the conventional message interchangers when a mobile 12 moves from a former SGSN 16 to a new SGSN 40. A Routing Area Update Request is sent to the new SGSN 40 by the ME 12, and the old and new SGSNs exchange messages with each other and with the Home Location Register (HLR) 46 in the home network. The first few conventional messages are:-

2 The new SGSN 40 sends to the former SGSN 16 a Context Request, and the former SGSN 16 responds.

3 Security functions are exchanged between the ME 12 and the new SGSN 40 and between the new SGSN 40 and the HLR 46.

4 The new SGSN 40 sends to the former SGSN 16 a Context Acknowledge message.

5 The former SGSN 16 begins to forward packets.

Subsequent conventional messages are illustrated in Figure 5.

In the inventive arrangement, when the former SGSN 16 receives the Context Request message, it creates a snapshot of the state model (i.e, in effect it freezes the old BCSM Instance 22 in the SSF 20) as indicated by box L, and sends the State Model Information with its Context Response message to the new SGSN 40, box M. The new SGSN 40 recreates the state model, box N, and then sends its Context Acknowledge message.

In variations, the transfer point need not be the former SSF 20 as illustrated in

Figure 4, but may be another convenient part of the network.

An advantage of the invention is that, within a GPRS environment, the SSF functionality remains at the SGSN; this avoids the need for redevelopment of the SSF at the GGSN, which would have been costly. Further, value-added Intelligent Network services, such as Virtual Private Network and freephone can be deployed as well as video and other real time applications without introducing a cumbersome anchoring technique in the SGSN, as is used in GSM.

CLAIMS

1 According to the invention, in a packet switched radio telecommunications network (10), a method of providing improved service when a mobile user (12) roams from association with one support node(16) to another support node(40) comprising the steps of:-

recording a state model of the call;

transferring the recorded state model from the former support node(16) to a new support node (40); and

recreating the state model in the new support node.

2 A method according to Claim 1 in which the state model is an object oriented model.

3 A method according to Claim 2 in which the state model is the Intelligent Network Switching State Model.

4 A method according to Claim 3 in which the objects in the Intelligent Network Switching State Model are legs (36), parties (30), connection points (34) and call sessions(32).

5 A method according to Claim 4 in which the state model comprises a Basic Call State Model and Points In Call and associated Detection Points provided in a Switching State Function.

6 A method according to any preceding claim in which the model is transferred from a Switching State Model in a former SGSN(16) to a Switching State Model in a new SGSN (40).

7 A method according to any preceding claim in which the state model is recorded when the former SGSN(16) receives a Context Request message from the new SGSN(40); in which the state model is transferred to the new SGSN in association

with the Context Response message by the former SGSN; and in which the state model is recreated in the new SGSN before it sends the Context Acknowledge message.

INVESTOR IN PEOPLE

Application No: GB 0017511.7 **Examiner:** Gareth Griffiths
Claims searched: All **Date of search:** 29 January 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): H4K (KFMA, KF42), H4L (LDGP, LRCMX, LRPLR, LRPMW, LRPMX)

Int Cl (Ed.7): H04Q 3/00, 7/22, 7/24, 7/38

Other: Online Databases: WPI, EPODOC, JAPIO, INSPEC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB2300334 A	(NORTHERN TELECOM)	
A	WO00/22839 A1	(NOKIA)	
A	US5839076	(BECHER)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.